

facts, and whoever attempts in the future to classify the Zoantharia must base his conclusions upon many of the anatomical details which are here for the first time adequately recorded.

No less than twenty-six species of corals, distributed among twenty genera, formed the materials of Mr. Duerden's investigations, and, although the descriptions are not exhaustive, there is a very full and interesting account of the general structure of all these forms.

The brilliancy of the colours of many corals in the living state has excited the interest and admiration of the naturalists and travellers who have visited coral reefs. These colours appear to be due to a variety of causes. In many cases the cavities of the polyps and the adjacent canals bear large numbers of the symbiotic algæ called Zooxanthellæ. The colour of these cells accounts for most of the prevailing brown and yellow-brown tints. In some few instances, such as *Astrangia solitaria* and *Phyllangia americana*, the Zooxanthellæ are nearly or wholly absent, and the polyps then are remarkably transparent and almost colourless. But there are in many cases definite pigment cells, both in the ectoderm and endoderm, which may add to or give the only colour effect of the expanded polyps. A third cause of colour is to be found in the boring filamentous red and bright green algæ with which many corals are infested.

The chapter dealing with the structure and arrangement of the tentacles is one of exceptional interest. To investigators in this country the tentacles have always offered difficulties and uncertainties. However carefully the

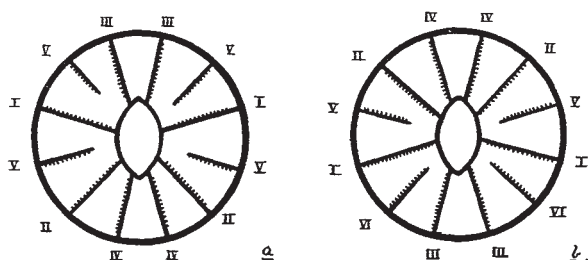


FIG. 1.—Diagrammatic figures showing the arrangement of the first six pairs of mesenteries in (a) *Madrepora*; (b) most other species of *Madreporaria*. The upper side of each is the side turned towards the axis (axial), and the lower is away from the axis (abaxial). The axial side of *Madrepora* is ventral, whereas in most other species it is dorsal. (The upper of the bilateral pairs marked v, v in a should have been v₁, v₁).

material they can obtain is preserved, it is impossible to prevent a great deal of retraction and shrinkage. Mr. Duerden's careful observations, therefore, of the fully expanded tentacles of his living corals form a particularly welcome addition to our knowledge.

The most elaborate, and perhaps we may say the most important, part of the author's work deals with the number and arrangement of the mesenteries. This is not the place to relate or to criticise details which are necessarily highly technical and somewhat intricate; but it may be said that it is upon the results of this part of his investigations that the suggestions he has to offer for the classification of the order very largely depend.

If we regard the *Madreporaria* as an order, we may divide it into two suborders:—(1) the *Entocnemaria*, (2) the *Cyclocnemaria*. In the former the mesenteries always arise in bilateral pairs, and beyond the protocnemic stage the increase takes place within one or both of the directive entocœles. In the latter the mesenteries, beyond the protocnemic stage, arise in isocnemic unilateral pairs within the primary exocœles. The *Entocnemaria* are represented only by the single section *Perforata*, the *Cyclocnemaria* by the two sections *Aporosa* and *Fungacea*. The arrangement of the families of the *Aporosa* into two groups, the *Gemmantes* and the *Fissiparantes*, based upon the method of asexual reproduction—by gemmation or by stomodæal fission—supported as it is by Mr. Duerden's later researches, can be regarded as only tentative and suggestive at present; but the facts upon which it is based are among the most interesting and important of his many results.

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It is a matter for regret, which many will share with the reviewer, that in the introduction to the systematic part of the memoir Mr. Duerden has not given us his views as to the relation of the *Actiniaria* to the *Madreporaria*, a difficult matter upon which no one is more competent to express an opinion.

There are some points in the terminology employed by Mr. Duerden that appear to me to be open to some objection. "By universal acceptance," he says, "Coenenchyme is the calcareous deposit originating from the coenosarc." This is most unfortunate. The word was introduced by Milne-Edwards and Haime to signify the common tissue which precedes the existence of the polyps and plays a considerable part in their constitution. In a similar sense Kölliker uses the expression as the tissue that gives rise to the axis of the precious coral. It was for the soft, not the hard, parts of the "common tissue" that the word was introduced. But to say that by "universal acceptance" the word is used for the calcareous deposit is not accurate, for the writers on Alcyonarians invariably use the word to signify both hard and soft parts, other than the axis, which lie between the neighbouring zooids.

Again, the use of the word "gastro-cœlom" for the general body-cavity of the *Cœlenterata*, suggesting as it does a compromise with the old-fashioned gastro-vascular cavity, is to be regretted. Either of the words "enterocœl" or "cœlenteron" is preferable.

On the other hand, the discussion (pp. 443-4) on the use of terms referring to the aspects of the *cœlenterate* body is excellent. The aspect of the body towards which the faces bearing the musculature of the two complete bilateral pairs of mesenteries, i, ii, are turned was called by Haddon the "sulcar" aspect, and the opposite the "sulcular" aspect. This terminology was adopted by Bourne in his "Anthozoa" of Lankester's "Treatise on Zoology." Marshall, in writing upon certain Alcyonarians, had previously used the terms "abaxial" and "axial" respectively, and these terms were introduced to supersede the "ventral" and "dorsal" of Moseley, Kölliker, and others. It is quite clear now from Mr. Duerden's remarks that the use of the newer sets of terms can lead to nothing but confusion. Anything that can be called a "sulcus" occurs only in Alcyonaria and a few Zoantharia; the "sulculus" is a myth.

But of more importance is the fact that, as shown by Carlgren, the "sulcus" is dorsal in *Cerianthus* and ventral in the other forms where it occurs. The axial-abaxial relationship, moreover, is not constant. In the Alcyonaria and in the majority of Zoantharia the dorsal aspect of the polyp is turned towards the axis of the colony, and the ventral aspect away from the axis; but in *Madrepora* this arrangement is reversed. In the solitary Anthozoa the use of the terms "axial" and "abaxial" has no meaning.

The conclusion is then that, although they are open to some objections, the use of the terms "dorsal" and "ventral" for the two aspects of the bilateral anthozoon must be retained.

In conclusion, Mr. Duerden may be congratulated on the production of a really great work which marks an important step forward in the history of our knowledge of the *Cœlenterata*.

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SEISMOLOGICAL NOTES.

IN No. 10, vol. ix., of the *Boll. Soc. Sismol. Italiana*, Dr. Agamennone records the fact that his idea of taking photographs, at intervals, from fixed points, in regions suspected of bradiseismic movements, was independently suggested by F. Salmojraghi. The object is to detect slow or rapid changes of relative level in the interior of a continent, where there is no such convenient datum level as is afforded by the sea, and the paper is specially devoted to showing that the effects of refraction, being irregular, would not prevent the detection of a bradiseismic change of relative level in a regular series of photographic records.

No. 23 of the *Mittheilungen* of the Austrian Earthquake Commission is a paper by Prof. Láska on the application of earthquake observations to the investigation of the constitution of the interior of the earth. From a consideration of the observations of the Caraccas earthquake of

October 29, 1900, in Europe and Japan, he arrives at the conclusion that if the earth consists of a central core and an outer shell, each of uniform composition, the outer shell must have a thickness of not more than 500 km. This result would fall in with Milne's hypothesis, but as this is considered to be inconsistent with the facts of astronomy, he adopts the conclusion that there is a continuous increase in the rate of propagation from the surface to the centre of the earth, this increase being much more rapid near the surface than at greater depths; this condition would result in the wave motion being propagated along curvilinear paths, and give rise to a small apparent rate of propagation near the origin as compared with that found at greater distances. The value of Prof. Láska's conclusion is diminished by the fact that it is based on the consideration of only a single earthquake, the time of origin of which is not known by direct observation.

In the *Boll. dell' Accademia Gioenia di Scienze Naturali in Catania* of February, 1904, Prof. Ricco returns to the consideration of the gravitational anomalies he has detected under Mount Etna, and shows that they are accompanied by corresponding irregularities in the course of the lines of equal magnetic force. Prof. Ricco merely records the fact of these magnetic irregularities, but the observation is important in its bearing on the explanation of the gravitational anomaly, which is equivalent to the removal of more than 1000 metres in thickness of rock, at sea level, from under the summit of the mountain. It is inconceivable that this can be due to the existence of huge cavities in the earth; more probably the effect is due to the existence of a "root" of the mountain, depressed into a denser magma, by the buoyancy of which the visible mountain is supported. There is independent geological evidence that Mount Etna lies over a region of special subsidence, the basis of sedimentary rock on which it was heaped up having been depressed during its formation, and if we suppose this depression to have caused the displacement of denser by less dense rocks to a considerable depth, we get an explanation of both gravitational and magnetic anomalies. A rough calculation shows that the buoyancy of the downward protuberance would, on the most favourable supposition, be inadequate to support the whole weight of the mountain, and it must be concluded that Mount Etna is not in a condition of complete isostasy, but partially supported by an upward force.

In No. 1 of the tenth volume of the *Bolletino* of the Italian Seismological Society Prof. Grablovitz discusses the vexed question of the nature of the wave motion in the third phase of the record of a distant earthquake. The occasion is the series of earthquakes which originated in the Balkan peninsula on April 4, 1904; as registered at Ischia, the great waves had a period of about 8 seconds, and, if the records of the horizontal pendula are interpreted as due to tilting, they indicate angular movements of as much as 100 seconds of arc, and this means a vertical movement of more than 2 metres; in the same earthquakes the instrument for recording the vertical component of the movement gave only negative results. From this Prof. Grablovitz concludes that the records obtained from the horizontal pendula and the *vasca sismica* are not due to tilting; he admits that there may have been a small amount of vertical movement which the instrument failed to record, but this must have been much smaller than that obtained by calculation in the ordinary way.

The same number contains a description, by Dr. Agamennone, of a new form of very delicate seismoscope, adapted for the detection of both near and distant earthquakes; and an account, by D. Vassallo, illustrated by a sketch plan, of the condition of Stromboli in June, 1904.

Dr. R. von Kövesligethy, of Budapest, has made an ingenious calculation of the work done by great earthquakes. Regarding the observed irregularities in the displacement of the poles as compounded of a regular epicycloid movement, and an irregular movement, which has been shown by Prof. Milne to vary with the frequency of great earthquakes, he calculates that each of the 200 great earthquakes registered during the eight years 1895-1902 caused an average displacement of the pole through $-0''.00275$; the negative sign is interesting, as showing that the tendency of great earthquakes is to diminish the departure of the instantaneous from the mean axis of revolution. The work done by this displacement is calculated as equivalent to that

which would be required to raise a mass equal to that of the earth through 1.2 mm. at its surface (*Die Erdbebenwarte*, iii., 1904, pp. 196-202).

Prof. Omori contributes a note on the variations of sea level on the east coast of Japan to part xiii. of vol. ii. of the reports of the Tokio Physico-Mathematical Society. The curves of barometric pressure and sea level are very similar, and approximately reversed; the maximum sea level is in September and the minimum in February, while the minimum barometric pressure is in July and the maximum in November. The range of barometric pressure is 9.3 m., corresponding to 126 mm. of sea level, while the range of sea level amounts to 276 mm. at Misaki and 219 mm. at Ayukaua; these figures show that while the local variations of barometric pressure doubtless influence the level of the sea, this is also dependent on the variations of barometric pressure over the Pacific Ocean. The net result is that the variations of pressure on the bed of the sea are the opposite of those on the adjoining land, and Prof. Omori correlates this fact with the observed variations in frequency of earthquakes originating off the east coast of Japan.

The *Deutschen Rundschau*, vol. xxvii., part i., contains an interesting note, originally printed in the *Honolulu Evening Bulletin* of June 21, 1904, by Dr. Otto Kuntze on the present condition of Kilauea, which he describes as being now dormant or extinct. There are no longer any "lakes of fire"; the old lake of lava has cooled, and is covered by a sheet of rock, and though steam issues from some of the cracks in this, no molten, or even red-hot, rock is now visible. A remarkable statement in the note is that the lava lake, formerly visible, did not mark an active vent, but was merely a reservoir of slowly cooling lava, which had flowed from the crater of Halemaumau and accumulated in the lowest part of the caldera of Kilauea. There is no authentic record of this crater, which rises from the floor of the caldera, having been in eruption since June 24, 1897, and the paper contains some strongly worded comments on the mis-statements regarding the present condition of the crater, printed in the guide books issued by the tourist agencies, mis-statements which are unnecessary, as Kilauea, even in its existing condition, is nevertheless one of the most interesting sights in the world, of which Dr. Kuntz claims that few have seen more than himself.

In No. 17 of the *Publications* of the Earthquake Investigation Committee in Foreign Languages, Mr. S. Kusakabe continues his investigations of the modulus of elasticity of rocks, and publishes some interesting results. He finds that all rocks show a marked hysteresis, that is to say, when exposed to a stress they go on yielding, apparently to an indefinite extent, though after a while the effect is masked by that due to changes of temperature, and when released from the stress the recovery takes place at a continuously decreasing rate, but apparently is never complete. Rocks in a state of strain have a higher modulus of elasticity than in the unstrained condition, and if exposed to a series of alternating stresses, increasing and decreasing in opposite directions, the mean modulus for the whole cycle is distinctly greater than that obtained by the usual method of determination. The mean modulus of elasticity decreases with the increase in amplitude of the cycle, from which it is concluded that the rate of transmission of earthquake waves is a function of their amplitude, and is less for a larger than for a smaller amplitude. The modulus of elasticity was found to have a maximum value at about 9°C. , and to decrease by about half per cent. of its value for each rise of one degree of temperature; from this it is inferred that there is a tendency towards a decrease in the rate of transmission as the depth of the wave path increases. On the other hand, the average rate of transmission is higher in Archæan and Palæozoic than in the newer rocks, and from these two considerations the deduction is drawn that there is a level of maximum velocity of transmission. We may point out that in arriving at this conclusion no account is taken of the increase in pressure with depth, and the consequent increase in compression of the rocks.

Prof. Imamura, in the *Tokio Sugaku-Butsurikagaku* (Tokio Physico-Mathematical Society), vol. ii., No. 13, adopts the same notion that there is a level of maximum rate of propagation, and places this level at a depth of a few hundred kilometres. The estimate is based on the

high rate of transmission, as much as 16 km. per second, obtained for near earthquakes by a calculation from the observed duration of the preliminary tremors, on the assumption that their rate of propagation is uniform. In another part of the paper he gives the results of direct calculation in the case of ten earthquakes the time of origin of which was known; for Tokio, at a mean epicentral distance of 665 km., the rates were 7.5 km. per second for the first, and 5.5 km. per second for the second, phase of the preliminary tremors, while Osaka, at a mean epicentral distance of 856 km., gave 8.2 km. and 5.8 km. per second respectively. These values may be accepted as more trustworthy than those obtained by the other method.

Globus of September 15 contains a note by Wilhelm Krebs on the distribution of submarine earthquakes, illustrated by a map of the world, on which all the recorded instances are plotted. Many of these are submarine volcanic eruptions, and their great concentration in the middle of the narrowest part of the Atlantic Ocean, between Africa and South America, is very striking. The utility of charts of this description would be much increased if they bore on their face indications of the principal trade routes of the oceans; as it is, some doubt may be felt as to whether the much greater frequency of recorded seismic phenomena in the Atlantic Ocean may not be due to a very large extent to the fact that this ocean is, proportionately, much more frequented than the Pacific. The other centres of activity, according to the map, are the West Indian islands, the west coast of South America, the south of the Bay of Bengal, the Malay Archipelago, the east coast of Japan, and the Mediterranean.

THE RACIAL ELEMENTS IN THE PRESENT POPULATION OF EUROPE.¹

THE lecturer opened his discourse with a graceful acknowledgment of the honour conferred upon him by the Anthropological Institute, and paid a respectful tribute to the memory of Huxley, who was the first to make the two-fold division of the peoples of Europe into xanthochroid and melanochroid races. With the name of Huxley he coupled the names of Beddoe and Broca as pioneers in European ethnographical research. To the two races mentioned above a third was soon added—the Mediterranean race—and the lecturer himself had in 1897 made a further step by dividing the population of Europe into six main races. He then dealt with criticisms which had been passed upon his own theories, chiefly by the American ethnologist Ripley, and stated that the further researches upon which he had continually been engaged since that date, and of which he was about to lay the results before the audience, had confirmed him in his first opinion. During a considerable number of years he had been diligently collecting statistics concerning the stature, colour of eyes and hair, and head measurements of the various nationalities, and now, in spite of certain *lacunae*, some of which he regretted to observe occurred in Britain, he was able to say that he possessed data covering the whole of Europe.

In no part of the world does there exist such a blending of races, such an intermixture of somatic characters, as amongst the ethnic groups which constitute the present populations of Europe, even when we make abstraction of the "national" groupings, such as Austro-Hungarian monarchy, for instance, and consider only the properly called ethnic or linguistic groups, like Slavic, Roman, Germanic, &c.

In an anthropological study of the European populations it is impossible to proceed in the same way as in the case of the majority of the so-called uncivilised peoples, where the measurements of a small series of individuals (often twenty or fifty) suffices to give an idea of the whole population.

Another method is required for the study of complicated ethnic groups. It is the combination of the statistical and the cartographical methods, in which the observations taken on many thousands of individuals permit the investigator to exclude the influence of accidental variations, and to

deduce one or several racial types in the population of a given region.

Such measurements concerning the principal racial characters, for instance, the stature, the colours of the hair and the eyes, the shape of the head (expressed principally by the cephalic index, i.e. the centesimal relation between the length and the breadth of the head), &c., have been made in nearly all the parts of Europe—especially by the examination of conscripts for the military service.

The only countries in which such measurements are now absent are Montenegro, some provinces of European Turkey and of Caucasus. Some other countries, and not of the least civilised, have not yet furnished sufficient information. For instance, there is no data concerning the cephalic index and the stature for Prussia and some other States of northern Germany; concerning cephalic index and pigmentation for Hungary, Roumania, and Servia; concerning the cephalic index for some parts of Switzerland, of Holland, of Russia, and, the lecturer regretted to have to mention that, for some parts of the United Kingdom.

The lecturer expressed then the hope that in a short time all these *lacunae* would disappear; considering this fact, that many serious efforts are made now for studying the populations in Germany, Roumania, Russia, and Great Britain. In every case this *lacunae* represent only a small part of Europe. For the rest, the details are sufficient, and furnish a basis for general deductions.

Taking the whole mass of these results (about 20,000, expressing the observations on more than 3,000,000 of individuals), and correcting them as to be comparable with each other, the lecturer explained how he put on the maps of Europe, of a comparatively large scale (1/10,000,000), district by district, this different data, and obtained in this way the distribution of every one of the principal somatic characters throughout the different regions of Europe.

Concerning the cephalic index, Europe can be divided into four regions:—

(1) A region of long-headed people with medium-headed areas in the north-west (Scandinavia, north of Germany, Holland, Great Britain).

(2) A region in the south-west (Portugal, Spain, south of Italy, east of Balkan Peninsula), characterised by even greater length of head.

(3) A very short-headed region in western Central Europe (south-eastern France, southern Germany, northern Italy, Switzerland) and in the immediate west of the Balkan Peninsula.

(4) A region comprising Russia and Poland subdivided into three, moderately long-headed in the centre, and medium-headed on the east and west.

After discussing these regions in detail, he proceeded to the subject of stature. He remarked that the great mass of his data was compiled from measurements taken on conscripts, and explained an ingenious method by which these measurements could be modified so that they represented fairly the typical stature of the full-grown male population. In Europe there are no people of very short stature according to the classification invented by Topinard (under 1,600 mm., or 63 inches); on the other hand, this continent is distinguished by the tallest race known, the Highlanders of Scotland. Hence, for the purpose of this lecture, he would speak of statures ranging between 1650 and 1675 mm. (65 inches to 66 inches) as *medium*, those below these measurements as *short*, and those above as *tall*. Tall statures are, with a very few exceptions, particularly well represented in the north-west; the rest of the population of Europe is, again with certain exceptions, chiefly in the Balkan Peninsula, of medium or short stature. People of medium stature are found grouped round the regions where the tall peoples occur, and connect the tall races of the north-west with those of the south-east. Short statures he divided into three groups, eastern (Russia), western (France), and southern (Spain and Italy), and showed how the eastern zone communicated by narrow "channels" with other centres of short stature.

In grouping the peoples of Europe with regard to colour of complexion, eyes and hair, he had taken as the basis of his classification the *brunette* type (eyes and hair dark brown or black), as the most easy of recognition. Those peoples among whom are found from 17 per cent. to 30 per cent. of brunettes may be called *intermediate*. Where less

¹ Summary of the Fifth Huxley Memorial Lecture, delivered before the Anthropological Institute of Great Britain and Ireland, on October 7, by Dr. J. Deniker, president of the Anthropological Society of Paris, to whom was presented the Huxley Memorial medal.